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MEMORANDUM

Date: March 12, 2019

To: Technical Staff, Connecticut Siting Council

From: Ifeanyi Nwankwo, Siting Analyst

Re: Report on the 2018 Connecticut State Building Code and Applicable Standards (TIA-222 REV G & TIA-222 REV H**)**

Introduction

Building codes are sets of regulations governing the design, construction, alteration and maintenance of structures. They specify the minimum requirements to adequately safeguard the health, safety and welfare of building occupants. Rather than create and maintain their own codes, most states and local jurisdictions adopt model building codes.[1]

The United States had three regional code organizations: Building Officials Code Administrators International (BOCA), Southern Building Code Congress International (SBCCI), and International Conference of Building Officials (ICBO). In 1994, these three groups formed the International Code Council (ICC). By the year 2000, ICC had completed the International Codes series and ceased development of the legacy codes in favor of their national successor.[2]

The ICC publishes new editions of the codes every three years and many states and localities have adopted them since the first editions were issued. The ICC's family of International Codes includes, but is not limited to:

- International Building Code (IBC): Applies to almost all types of new buildings
- International Residential Code (IRC): Applies to new one- and two-family dwellings and townhouses of not more than three stories in height
- International Existing Building Code (IEBC): Applies to the alteration, repair, addition or change in occupancy of existing structures.

The 2018 Connecticut State Building Code

According to the Office of the State Building Inspector, the 2016 Connecticut State Building code (CSBC) is based on the ICC's 2012 International Building Codes and applies to projects with permit applications filed from October 1, 2016 to September 30, 2018.[3] The 2016 SBC adopts the following model codes:

- 2012 International Building Code
- 2012 International Existing Building Code

[1] https://www.fema.gov/building-codes
[2] https://en.m.wikipedia.org/wiki/International_Building_Code
[3] https://portal.ct.gov/-/media/DAS/Office-of-State-Building-Inspector/2016_connecticut_state_building_code.pdf?la=en

- 2012 International Plumbing Code
- 2012 International Mechanical Code
- 2012 International Residential Code
- 2012 International Energy Conservation Code
- 2014 National Electrical Code (NFPA 70)
- 2009 ICC A117.1 Accessible and Usable Buildings & Facilities

In contrast, the 2018 Connecticut State Building Code is based on the ICC's 2015 International Building Codes and references the ICC A117.1-2009 standard for accessibility, and applies to projects with permit applications filed from October 1, 2018.[4]
The 2018 SBC adopts the following model codes:

- 2015 International Building Code
- 2015 International Existing Building Code
- 2015 International Plumbing Code
- 2015 International Mechanical Code
- 2015 International Residential Code
- 2015 International Energy Conservation Code
- 2017 National Electrical Code (NFPA 70)
- 2009 ICC A117.1 Accessible and Usable Buildings & Facilities

The 2015 International Building Code

The most current version of the 2015 IBC was published by the ICC in October of 2015 and was adopted by jurisdictions that acknowledge the ICC.[5]

Section 3108 of the 2015 IBC relevant to telecommunications and broadcast towers states in item 3108.1 that "Towers shall be designed and constructed in accordance with the provisions of TIA-222".[6]

Clearly, the 2015 IBC specifically recognizes the TIA-222 Standard as the guideline for communication tower design and analysis and fundamentally accepts the TIA-222 structure classification as the basis required for telecommunications and broadcast towers.

It is also important to note here that the 2015 IBC does not specify which revision of the TIA-222 is applicable.

The TIA-222 Structural Standard for Antenna Supporting Structures, Antennas and Small Wind Turbine Support Structures

The TIA-222 standard published by the Telecommunications Industry Association, determines the minimum wind, ice and earthquake loading requirements for new and existing telecommunications and antenna supporting structures. This is based on certain criteria that determine the reliability of the structure and that are established by considering the consequences (risk) of failure of the structure depending on its use and

[4] https://portal.ct.gov/-/media/DAS/Office-of-State-Building-Inspector/2018-CT-State-Building-Code---Effective-10-01-18.pdf?la=en
[5] https://development.bellevuewa.gov/UserFiles/Servers/Server_4779004/File/pdf/Development Services/codes_2015IBC_read-only.pdf
[6] https://codes.iccsafe.org/content/IBC2015/chapter-31-special-construction

location. For a communication structure, use is defined by the types of services provided by the equipment supported by the structure. As a result, tower structures are divided into various risk categories.

Tower structures that fall under these risk categories are structurally assessed using class-specific criteria such as:

a) Wind speeds/loading, ice loads and seismic loading; and
b) Site exposure such as terrain, natural topography, vegetation and surrounding facilities;

Revision G

The TIA-222 Rev G standard, which had its last update published in 2006, has 3 classes of risk category for communication structures.[7]

Structure Class I:
These are structures that due to height, use or location represent a low hazard to human life and damage to property in the event of a failure, and failure of the structure typically only affects the owner. Examples include: residential wireless and conventional two-way radio communications; television, radio and scanner reception etc. Failure of structures in this class typically only affect the owner and human life is essentially not at risk.

Structure Class II:
Structures that due to height, use or location represent a significant hazard to human life and/or damage to property in the event of failure and/or used for services that may be provided by other means. Examples include: commercial wireless communications; television and radio broadcasting; cellular, PCS, CATV, and microwave communications.

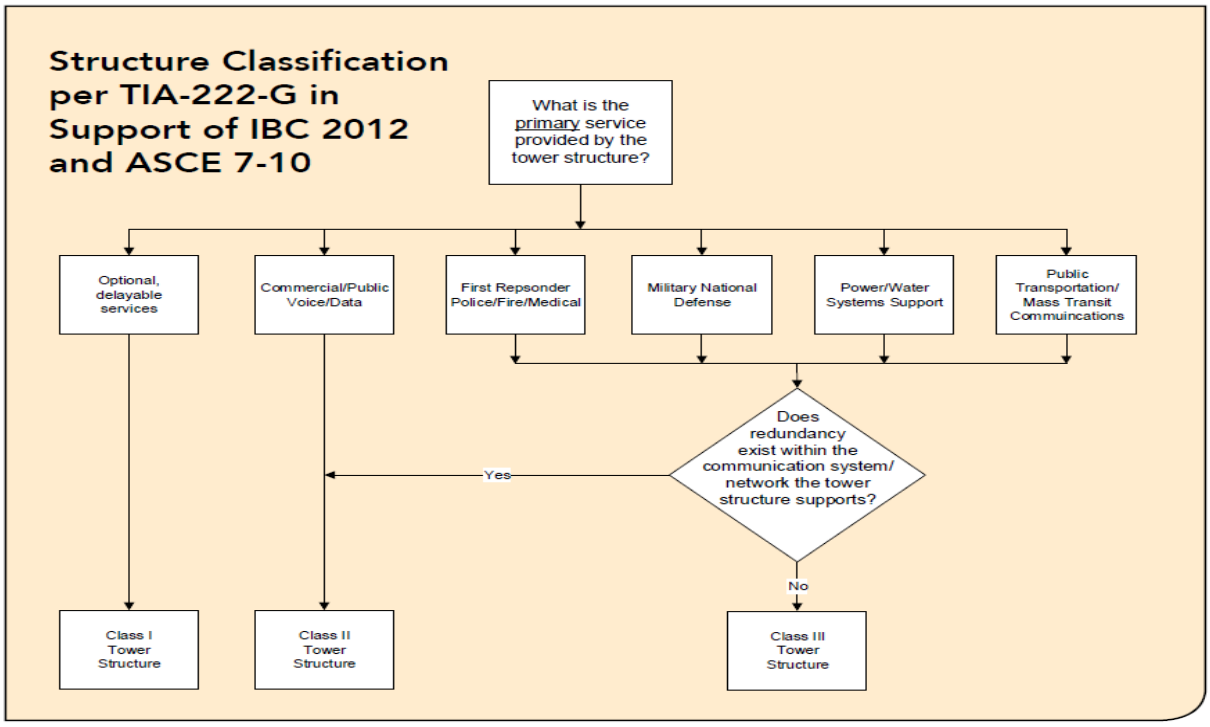
Structure Class III:
Structures that due to height, use or location represent a substantial hazard to human life and/or damage to property in the event of failure and/or used primarily for essential communications, such as civil or national defense, emergency, rescue, or disaster operations, military and navigation facilities.

The assigned class for a structure determines the reliability requirements used in the assessment of its structural integrity and ability to carry the proposed loads/equipment. The impact of the elements on these structures varies by class, such as wind speed with ice, wind speed with no ice, weight of ice, etc.

An example of changes in the TIA-222 revisions is highlighted in the fact Rev G considers a 3 second gust wind speed while its previous version Rev F considered the fastest mile wind speed. For a given location, the 3-second gust wind speed represents the peak gust wind speed whereas the fastest-mile wind speed represents the average wind speed over the time required for one mile of wind to pass the site.

The wind speed is also adjusted based on the terrain in which the structure is located. These are called Exposure Categories.

[7] https://tirap.org/wp-content/uploads/2017/06/PAN_ClassTwrStructures_Jan-Feb_2017.pdf



Revision H

The TIA-222 Rev H standard[8] was published on January 2018 and included the following changes:

- The use of ultimate gust wind speeds;
- Updated seismic loading considerations;
- Design provisions in line with AISC 360 steel design;
- Enhanced standards for Foundations and Climbing facilities; and
- The addition of a fourth structural class.

The Rev H standard clearly reflects the impact/results of technological advancements and research on the various factors that determine the reliability requirements of a tower structure.

[8] https://wia.org/wp-content/uploads/White-Paper-Risk-Categorization-in-Accordance-with-ANSI-TIA-2018-IBC-May-2018.pdf

Below is a table showing Rev H extreme wind loading based on risk category:

Risk Category	Return Period	50-yr Probability of Exceedance	Example Design Wind Speed, MPH
I	300 years	15%	106
II	700 years	7%	114
III	1700 years	3%	122
IV	3000 years	1.6%	127

In addition to the structure classes itemized in Rev G above, the TIA-222 Rev H standard incorporates an additional fourth risk category which determines the reliability requirements for structures that due to use or location represent a substantial hazard to the community in the event of failure.[9] Structures in this category are those that in the event of failure would threaten the functionality or integrity of facilities that are designated as Risk Category IV facilities such as:

- Surgery or emergency treatment facilities.
- Fire, rescue, ambulance and police stations and emergency vehicle garages.
- Designated earthquake, hurricane or other emergency shelters.
- Designated emergency preparedness, communications and operations centers and other facilities required for emergency response.
- Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures.
- Buildings and other structures containing quantities of highly toxic materials that:
    - Exceed maximum allowable quantities per control area or per outdoor control area in accordance with the International Fire Code; and
    - Are sufficient to pose a threat to the public if released.
- Aviation control towers, air traffic control centers and emergency aircraft hangers.
- Buildings and other structures having critical national defense functions; and
- Water storage facilities and pump structures required to maintain water pressure for fire suppression.

Summary of Facts

The 2018 Connecticut State Building Code adopts the 2015 International Building Code, which at the time of publication incorporated the TIA-222 standard.

The TIA-222 standard provides an accurate and reasonable classification of tower structures and the criteria used in the structural assessment of each structure class.

The most relevant and current TIA-222 standard at the time of publication of the 2015 IBC is the TIA-222 Rev G.

[9] https://wia.org/wp-content/uploads/White-Paper-Risk-Categorization-in-Accordance-with-ANSI-TIA-2018-IBC-May-2018.pdf

The TIA-222 Rev H is the latest accredited standard published by the Telecommunications Industry Association.

The Telecommunications Industry Association encourages practicing professionals to use the latest version of the TIA-222 standards in their assessments.

Both Rev G and Rev H could be applied in the 2015 International Building Code.